

Visiting Scientist Program: A/Prof Charitha Pattiaratchi

A/Prof Charitha Pattiaratchi
Centre for Water Research
The University of Western Australia
Nedlands, WA 6907, Australia
phone (61) 8 9380-3179 fax (61) 8 9380-1015 email: pattiar@cw.r.uwa.edu.au
Person Visited: Roy Wilkens
Office of Naval Research
800 N. Quincy St, Arlington, Virginia
Phone: (703) 696 7237 fax: (703) 696 7237 email: Roy_Wilkens@onr.navy.mil
Person Visited: Michael Richardson
Naval Research Laboratory
Stennis Space Center, MS 39529-5004
Phone: (228) 688-4621 fax: (228) 688-5752 email: mike.richardson@nrlssc.navy.mil
Person Visited: Todd Holland
Naval Research Laboratory
Stennis Space Center, MS 39529-5004
Phone: (228) 688-5320 fax: (228) 688-4476 email: tholland@nrlssc.navy.mil
Award Number: *VSP 4041*
<http://www.cwr.uwa.edu.au>

LONG-TERM GOALS

To investigate, using field, remote sensing and numerical modelling approaches, coastal physical oceanographic processes in estuarine, nearshore and continental shelf regions. In particular, processes relevant to: (a) circulation and mixing; (b) sediment dynamics; and, (c) interaction between flow and topographic features will be undertaken.

OBJECTIVES

To develop collaborative research efforts in coastal sediment dynamics which could contribute to the ONR's efforts into Mine Burial Prediction Research.

APPROACH

The objectives were achieved by visiting relevant personnel at ONR Headquarters (Wilkens) and at the National Physical Laboratory (Richardson, Holland). During these visits an overview seminar on current research undertaken by Pattiaratchi was presented. Current research programs within ONR and avenues for collaboration were discussed.

TRAVEL COMPLETED

Table 1. Summary of visits conducted under this VSP.

Person Visited	Position	Institution	Location	Purpose	Dates
N/A	N/A	USGS, Woods Hole, MA	Woods Hole, MA	Community sediment transport workshop	07/22/00 – 07/23/00
Roy Wilkens	Head, Marine Geology and Geophysics	Office of Naval Research	800 N. Quincy St, Arlington, Virginia	Discussions on future collaboration	07/26/00
Todd Holland	Nearshore Morphology team, Code 7440.3	Naval Research Laboratory	Stennis Space Center, MS 39529-5004	Discussions on future collaboration	07/26/00 - 07/27/00
Mike Richardson	Head, Seafloor Sciences Branch, Code 7430	Naval Research Laboratory	Stennis Space Center, MS 39529-5004	Discussions on future collaboration	07/26/00 - 07/27/00

RESULTS

The VSP visit included three separate site visits and these are described below:

Community Sediment Transport Modeling Workshop: A summary of the workshop and a summary of outcomes are given as an appendix to this report.

ONR Head Office (Roy Wilkens/ Joe Kravitz): I presented a seminar on the current research which is being undertaken by the Coastal Oceanography Group at the Centre for Water Research. Further discussions with Dr Wilkens alerted me to the proceedings of a mine burial prediction workshop website: <http://ocean.st.usm.edu/~cwcurrey/mineburial.html>. In addition, I discussed various funding opportunities (eg NICOP) which are available for future collaborative work.

NPL, Stennis Space Centre (Mike Richardson/Todd Holland): I presented a seminar on the current research which is being undertaken by the Coastal Oceanography Group at the Centre for Water Research. Subsequently I had several discussions with various personnel and a summary is given below:

Holland/ Puleo: I was very impressed by the work undertaken by Holland and Puleo, in particular, the swash zone hydrodynamics studies undertaken using video analysis. This is a very powerful method in which this challenging region, in terms of field measurement, can be studied in detail.

Richardson: I was introduced to the program of instrumented mines used in the field by Mike Richardson. This was of great interest to me and was my first introduction to such a device. Based

on my experience, I suggested some improvements to the instrumented mine: (a) use of optical backscatter instruments to determine the amount of burial – this would reduce the number of protrusions which can affect the hydrodynamic field in the vicinity of the instrumental mine when compared to the prototype. (b) use stress/strain sensors on the body of the instrumented mine to measure the hydrodynamic forces. This data could be used to validate numerical models of mine prediction. I also discussed the dynamics of tidal bedforms and explained that the migration of bedforms depends mainly on the size of bedform: in general larger bedforms (sand ridges, sand waves) do not migrate whilst smaller bedforms (mega-ripples) migrate and can reverse in direction with tidal state.

Gallegos: I also has discussions with Sonia Gallegos with regard to analysing SeaWiFS data for the West Australian coastline and the effects of tropical cyclone (Hurricane) generated continental shelf waves in remote forcing (up to 2000 km away) of shelf and estuarine dynamics.

IMPACT/APPLICATIONS

As a result of the knowledge gained by attending the community sediment transport workshop and visits to ONR Head Office and NPL I have gained an insight to current status of coastal sediment transport modelling (see summary of workshop attached), current research efforts from ONR and NPL with regard to Mine Burial processes. Based on this knowledge, I am now in a position to relate my own research efforts to ONR's efforts into Mine burial prediction research.

TRANSITIONS

N/A

RELATED PROJECTS

The coastal oceanography group undertakes fundamental and applied research projects in coastal oceanography, in particular on coastal and estuarine sediment dynamics, nearshore processes and circulation and mixing on the continental shelf. Current and recent projects appear on the University of Western Australia, Centre for Water Research, Coastal Oceanography home page (<http://www.cwr.uwa.edu.au/space/CoastalOceanography/index.html>). A summary version may also be found at: <http://www.ehis.navy.mil/onrnews/butler/metoc-00-01.doc>.

Title of workshop: COMMUNITY SEDIMENT TRANSPORT MODELING WORKSHOP

Dates of event: Thursday June 22 & Friday, June 23, 2000, Woods Hole, MA

Scientific Committee

Chris Sherwood (US), Rich Signell (US), Courtney Harris (US)

Goals and Objectives of Workshop

- Review existing sediment-transport models and development efforts
- Identify the physical processes and parameterizations required to represent coastal sediment transport
- Develop minimal standards, simple tests, and common data sets for inter-model comparisons.
- Propose a plan for establishing a community model
- If need be, identify suitable institutional host(s) for the model(s)

Short summary of scientific progress achieved

The workshop convenors have prepared a draft executive summary and is reproduced below:

A group of 55 scientists and engineers from nine countries met in Woods Hole, Massachusetts on June 22-23, 2000 to explore a community approach to improving deterministic models of sediment transport in coastal seas, estuaries, and rivers. The motivation was that there did not appear to be any well-tested models that had been accepted by the research community, and that identification or development of such a model would enhance our ability to use sediment transport models as research tools.

Development of widely accepted sediment transport models will make models more effective tools for scientific research. Hydrodynamic models that incorporate sediment transport processes are available, but are not widely used by the sediment transport research community. This is because no existing model has the features that would allow wide access and acceptance by the community: freely available code, state-of-the-art hydrodynamic and sediment algorithms with modern, modular coding, comprehensive documentation, and demonstrated performance on a suite of community defined test cases. A significant effort is needed to make models more usable by the research community, and to test available and developing models.

A better understanding is needed of the basic physics that control sedimentary processes such as bottom roughness, aggregation or flocculation and disaggregation, erosion and deposition, and bed consolidation. While the requisite observations and theoretical studies are beyond the scope of a modeling effort, a well tested community model would provide a valuable platform for testing and comparing emerging parameterizations of sedimentary processes. Our ability to realistically simulate sediment transport is often limited by our ability to formulate laws for essential sediment processes from first principles, not by the efficiency and sophistication of our numerical models. Because we may not achieve this ability for some years, we need to use models as a context for developing and testing improved parameterizations of these processes. First, however, the models

must have a demonstrated ability to correctly model basic problems. Small working groups should be formed from the community to identify the most-important basic research directions relevant to realistic modeling and propose guidelines for appropriate and specific tests.

Coordination of the community modeling effort should be by an impartial organization with long-term stability. Although the development effort can be shared by the community to some extent, there needs to be sustained support of core activities to: guide development efforts, facilitate evaluation by providing test cases, maintain the source code and user documentation, develop a forum for user group discussion, and maintain the branch web site. This core activity is most likely to be successfully if undertaken by an organization whose mission and expertise involves sediment transport and has long-term stability.

Proceedings of the Workshop

The organizing committee will generate a workshop report that will be circulated to participants for comment. The report is available in draft form at: http://oracle.er.usgs.gov/sed_workshop/. The final report will be available at the same site after 15 September 2000.

Financial Support

Financial support was provided by USGS.

Countries represented and number of participants

USA, Canada, UK, Denmark, Australia, Indonesia, Korea, Norway: 55 participants
(full attendance list is available at: http://oracle.er.usgs.gov/sed_workshop/attendees.htm)

SCIENTIFIC PROGRAM

Community Sediment Transport Modeling Workshop: Agenda

Day 0: Wednesday, June 21, 2000:

Arrive to Woods Hole in Afternoon/Evening and check in to Shoreway Acres.

Day 1: Thursday, June 22: Carriage House, Quissett Campus, WHOI

8:30- 8:45 Welcome and Review of Workshop Goals - Sherwood

8:45-10:00 0-2 minute introductions: 1 overhead max from attendees

10:00-10:20 Break

10:20-12:25 Challenges affecting coastal sediment transport

Challenges in cohesive sediments. A. Mehta

Challenges in noncohesive sediment dynamics. O. Madsen

Challenges in sediment erosion processes. J. Lick

Challenges in coastal wave processes. S. Elgar

Challenges in coastal circulation processes. R. Geyer

12:25-1:15 Lunch

1:15-3:20 Existing Deterministic Sediment Transport Models:

- How are non-cohesive and cohesive sediments handled?
- What are the strengths of the model?
- How the model has been assessed?
- What further developments of this model have the highest priority?

EFDC - Ji

MIKE21 - Zyserman

ECOMSED - Shrestha

UF-CH3D-IMS - Sheng

WES-CH3D-SED - Raphael

3:20-3:45 Break

3:45-5:00 Developing or Related Community Modeling Efforts

- Nearshore Community Model (NOPP) - Kirby
- Regional Ocean Modeling System (ROMS) - Styles/Arango
- A Coupled Hydrodynamic-Ecological Model for Regional and Shelf Seas (COHERENS) - Souza

Day 2, Friday, June 23: Carriage House, Quissett Campus, WHOI

8:30-8:45 Defining the ideal sediment transport modeling system
(charge to working groups) - Harris

8:45-9:00 Break (for working groups to get to places to meet)

9:00-11:00 Working groups meet to DEFINE THE IDEAL SYSTEM

What does a system need to be a community sediment transport model?

What are the capabilities of current models, and how should they be improved:

- Scientifically? (improve model's capability to handle processes and be applied to specific environments)
- Numerically? (enhance model algorithms).
- Logistically? (provide user manuals, visualization tools, etc.).

11:00-11:15 Break (for working groups to get back to Carriage House)

11:15-12:05 10 minute statement from each working group

12:05-1:00 Lunch

1:00-1:15 How do we build the ideal system? (charge to working groups) – Signell

1:15-1:30 Break (for working groups to get to places to meet)

1:30-2:30 Working groups evaluate HOW TO BUILD THE IDEAL SYSTEM.
(same 5 groups as morning)

- Is there an identified starting point for such a system?
- What roles should be played by commercial, academic and government scientists?
- What development style is most appropriate for this system?
- How can the system be funded?
- What specific role should USGS play in the development?

2:30-2:45 Break (for working groups to get back to Carriage House)

2:45-3:35 Ten minute statements from working groups.

3:35-4:00 Discussion/concensus on the major workshop findings and conclusions.

4:00 Meeting adjourned.